

Cowings, P.S., W.B. Toscano, C. DeRoshia, B. Taylor and S.Hines. Development of an index of habitability using converging indicators: Physiology, performance and subjective reports. Paper presented to Second Biennial Space Human Factors Workshop, Houston, TX, Jan 23-24, 2002

Abstract

The purpose of this research is to develop and validate a quantitative method for assessing environmental effects on individual crewmembers during extended duration spaceflight. Results from earlier research have shown a strong association between physiological response magnitudes (reactivity) and motion sickness severity, performance decrements during field operations in combat vehicles, and the effectiveness of mitigating these problems using behavioral techniques. However, analyses that address individual differences and the extent to which physiological and other behavioral variables can predict changes in performance are lacking. Therefore, the primary focus of this project will be to examine those combinations of variables or indicators (e.g., physiological responses, mood states, malaise levels, and sleep quality) which can best predict an individual's operational efficiency. This work will involve analyses of existing data obtained from laboratory experiments, field studies with military personnel, and data from a small sample of astronauts and cosmonauts during short and long-term spaceflight. Some of the questions to be addressed by this research are:

1. Some individuals can adapt to motion sickness inducing environments better than others. Are there physiological patterns that identify good and poor adapters?
2. Some individuals benefit more from physiological feedback training than others in management of their motion sickness symptoms. Are there physiological patterns that identify good and poor learners”?
3. There are large individual differences in the effects of promethazine on performance, mood and motion sickness tolerance. Are there physiological patterns that identify those individuals with the largest performance decrements and those who are least affected?
4. In an operational field test of an Army combat vehicle (C2V) subjects showed performance decrements and increased symptoms while the vehicle moved. Is there a consistent “map” of these converging indicators for an individual that is repeatable from test to test?

Progress to date includes: initiated transfer of archived physiological data from analog to digital format, developed custom software (PC-based) for processing and editing data (software tests incomplete), begin development of database on PC platform, begin transfer of data to new database and integrate performance and self-report data, initiate data analyses. We anticipate that the deliverable from this research will be a reliable quantitative method for accurately evaluating the effects of microgravity on crew functional state (i.e., his/her health, emotional well-being, safety, and operational performance) and for evaluating countermeasures that may facilitate adaptation to space and re-adaptation to Earth.